TNT EXPLOSIVES TEST KIT INSTRUCTION GUIDE

TK-1004-1
800-544-8881

IMPORTANT

Read all instructions and handling procedures before using this kit. For assistance call the TECHNICAL SERVICE HOT LINE 1-800-544-8881

INTENDED USE

The D TECH® TNT (1,3,5-Trinitrotoluene) on-site and laboratory test kit is designed to provide quick, semiquantitative and reliable test results for making environmental decisions. The D TECH® TNT Test Kit can be used on-site for identifying "hot spots", site mapping, monitoring of remediation processes and selecting site samples for laboratory analysis. In the laboratory, the D TECH® TNT Test can screen highly contaminated samples that require pre-dilution prior to instrumental analysis. The D TECH® TNT Test Kit has a working range of 0.5 to 5.0 ppm in soil and 5 to 45 ppb in water.

PRINCIPLE

The D TECH® system for analyzing trace amounts of TNT utilizes immunoassay technology. This proven technique uses an antibody as an analytical reagent. Antibodies are biological molecules with the ability to specifically bind only the target compound amidst a complex sample matrix, thus eliminating the need for extensive sample cleanup. By linking the unique antibody selectivity with a sensitive color indicator system, very low concentrations (ppm, ppb) of target compound can be determined. The color formed is inversely related to TNT concentration. In this assay the antibody primarily reacts with TNT and may react to some extent with Tetryl, 1,3,5-TNB and 2A (2-amino-4,6-DNT). See the D TECH® brochure "Immunoassay Comes To Environmental Testing" for a detailed explanation of the unique immunoassay format used.

TEST KIT DESCRIPTION

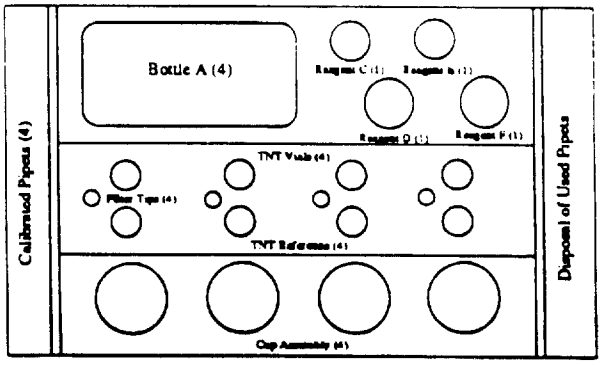
The D TECH® TNT Test Kit, Item # TK-1004-1, contains sufficient materials to perform four tests. This kit can test water samples or be used with the D TECH® TNT/RDX Soil Extraction Pac, Item # TK-1001S-1, to test soil samples. The TNT/RDX Soil Extraction Pac contains only the materials needed to extract TNT from soil for semi-quantitation with this D TECH® TNT Test Kit. The results can be obtained by using the enclosed Color Card or *the* DTECHTOR Meter, Item # TK-1001M-1.

STORAGE AND STABILITY

This kit has a working temperature range from 45° to 100°F (7° to 38°C). For optimal stability, the kit should be stored from 40° to 100°F (4° to 38°C). Do not store the kit in direct sunlight. The expiration date varies with storage temperature. For expiration dating under various storage conditions, see the package label.

MATERIALS PROVIDED

See the tray diagram below. This diagram includes the kit component names and quantity of each item.



Not shown in diagram

Used Kit Label (1)

Instruction Guide (1)

Color Card (1)

ACCESSORIES SUPPLIED BY USER

- Timing Device (minutes)
- D TECH® TNT/RDX Soil Extraction Pac, Item # TK-1001S-1 (if testing soil samples)
- *the* DTECHTOR Meter, Item # TK-1001M-1 (optional)

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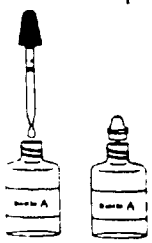
Important: **Once the test is initiated, all steps must be executed sequentially without stopping. Please read all the Health and Safety Comments on page 7 prior to use.**

Note: This package is designed to serve as a WORK STATION. At the conclusion of the test, the components can be left in the package for proper disposal.

Step 1: Choose the corresponding sample source to determine the first step.

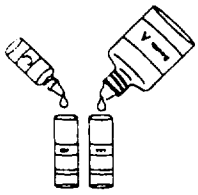
WATER SAMPLE: Using a clean calibrated pipet, transfer **1.0 mL** of a water sample to **Bottle A**. Snap a filter tip on **Bottle A** and gently mix by inverting three (3) times.



SOIL SAMPLE: Using a clean calibrated pipet, transfer **1.0 mL** of **Bottle 2** (soil extract) solution from the D TECH® TNT / RDX Soil Extraction Pac. (Item # TK-1001S-1) to **Bottle A**. Snap a filter tip on **Bottle A** and gently mix by inverting three (3) times. Re-cap **Bottle 2** and set aside.

Note: The vials in the next two steps need to stand 2 minutes (+/- 15 seconds) after liquid is dispensed into them. The solutions in these vials will remain hazy.

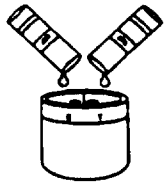
Step 2: Squeeze **Bottle A** filling the **TNT Test Vial** (gray stopper) to a level between the two lines (approximately 13-14 drops). Gently mix by shaking the vial in a back and forth motion. Immediately proceed to step 3.



Step 3: Squeeze the contents of **Reagent C** (white cap) to fill the **TNT Reference Vial** (red stopper) to a level between the 2 lines. Gently mix by shaking the vial in a back and forth motion.

Note: Reconstitute the REFERENCE VIAL IMMEDIATELY after sample addition to the test vial. If analyzing several samples simultaneously, reconstitute a reference vial at the same time each test (sample) vial is filled.

Step 4: After 2 minutes (+/- 15 seconds), pour contents of the **TNT Test Vial** into the **T** (test) side of the cup assembly. Immediately pour the contents of the **Reference Vial** into the **R** side of the cup assembly. Allow the liquid to drain completely on both sides.



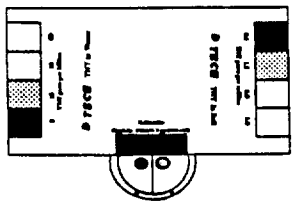
Note: The next four (4) steps use dropper-tipped bottles. When dispensing these reagents, do not allow any dropper tip to contact any solution(s) or surface in the cup assembly. To assure uniform color development across the cup assembly, dispense the drop onto the sloped side of the well to lessen its impact. Do not allow the drop to fall into the middle of the well.

Step 5: Add 10 drops (+/- 2 drops) of **Reagent D** solution (yellow cap) into each side of the cup assembly. Allow the liquid to drain completely.

Step 6: Add 5 drops (+/- 1 drop) of **Reagent E** solution (blue cap) to each side of the cup assembly. Be sure to add this solution immediately to the second well after addition to the first well. Allow the wells to drain com-

Step 7: Read the Reference Color.
If using *the* **DTECHTOR** meter, proceed directly to *the* **DTECHTOR** meter Set Up section on page 3.

If using the **Color Card**, compare the color of the **R** (left) side of the cup assembly to the reference bar of the **Color Card**. When the color of the **R** Side matches the reference bar, the color development process should be stopped. Proceed to **Step 8.**



Note: The color development time is temperature dependent and takes approximately 10 minutes at 75°F. More time is required at lower temperatures and less time is required at higher temperatures.

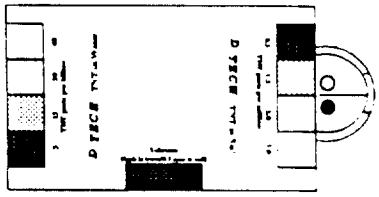
Step 8: Add 8 drops (+/- 2 drops) of **Reagent F solution (red cap) into each side of the cup assembly. Allow to drain completely. Now determine the TNT concentration of the sample.**

Note: The color in both wells is stable for approximately four (4) hours.

DETERMINING TNT CONCENTRATION

The results from the D TECH® TNT Test Kit can be determined using either the **Color Card** supplied with the kit or *the* **DTECHTOR** meter and the table provided below.

COLOR CARD: Match the color on the **T** side of the cup assembly to the **Color Card** using the appropriate soil and water color bars. If the color of the test does not exactly match a panel of the color card, user interpretation is required.



and/or

the DTECHTOR: Determine the % relative reflectance using *the* **DTECHTOR** (see Instrument Operator's Guide for complete instructions). Use the conversion table to determine the concentration range of TNT Equivalents in the sample.

the DTECHTOR METER SET UP

the **DTECHTOR** must be calibrated each time the meter is turned on. Calibrators are provided with the meter for this purpose. The **Calibrator** must be clean and white to insure valid results.

Note: For best results, do not take DTECHTOR readings in direct sunlight.

Step 1: Insert **Calibrator** into the **Meter Head** and hold firmly in place. (ZERO)

Step 2: Press the Square Button 1 time. When calibrated, the meter will display. . . . (SET)

Step 3: Remove the **Calibrator** and return it to its protective cannister. The display remains . . . . (SET)

Step 4: Press the Square Button 1 time to select meter program #1 (the Program to be used for this D TECH® TNT test). (SET#1)

Step 5: Insert the Cup Assembly (test) into the Meter Head and firmly hold in place. (TEST#1)

Note: The #1 in the upper right corner of the display window in Steps 4 & 5 corresponds to the meter program number being used to obtain the meter reading

Step 6: To read the reference color, double click the **Red** Square Button (as you would with a computer "mouse") to determine the color of the reference well. (- - - -)

Step 7: If the reference reading is between 210 and 250 proceed to Step 8. Otherwise, the device needs to develop longer. Wait approximately 30 seconds and repeat Step 6. (220)

Note: If the reference side reading is below the target range, color development has proceeded too long. If this situation occurs, the test should be rerun. The most accurate result interpretation is achieved when the test is read when the reference side reading is within the target range.

Step 8: Obtain the result by **immediately** pressing the **Red** Square Button 1 time. (- - - -)

Obtain the meter reading. For example..... (45%)

Step 9: Record the result then press the **Red** Square Button 1 time while holding the Cup Assembly in place. (- - - -)

Step 10: (Optional) Key in a 4 digit sample ID code number. (This feature can be used for sample identification if the data is to be downloaded to a computer.)

Step 11: Remove the **Cup Assembly**.

Step 12: Insert the next **Cup Assembly** (test) and repeat Steps 5 - 11. (SET#1)

the DTECHTOR TABLE

Sample	*the* DTECHTOR Reading	Total TNT Equivalents
Water (ppb)	LO	< 5
	1 - 30	5 - 15
	30 - 50	15 - 25
	50 - 75	25 - 45
	HI	> 45
Soil (ppm)	LO	< 0.5
	1 - 15	0.5 - 1.5
	15 - 45	1.5 - 3.0
	45 - 60	3.0 - 4.0
	60 - 75	4.0 - 5.0
	HI	> 5.0

PRECAUTIONS AND PROCEDURAL NOTES

TEST PROCEDURE:

- The test should be run at a temperature range of 45° to 100° F (7° to 38°C).
- The kit may be stored at a temperature range of 40° to 100°F (4° to 38°C). Storage at higher temperatures may irreversibly damage the reagents. Do not store the kit in direct sunlight. See the lot number label for additional storage information.
- Check the expiration date on the bottom of the kit prior to use. The expiration date is dependent on the storage temperature of the kits.
- Reagents from different kits CANNOT be mixed.
- SALT WATER samples (ocean, sea, etc.) require a special sample preparation step. Please contact our technical service hotline at 800-222-0342 for further information.
- Once initiated, the test should be run as quickly as possible. DO NOT STOP BETWEEN STEPS.
- The diluted sample extract and the reference reconstitution diluent should be at approximately the same temperature prior to adding either to their respective test or reference vial.
- This test is temperature dependent. The reference serves as an incubation time indicator. DO NOT stop the test (Step 8 on page 2) until the color intensity produced in the reference well matches the color bar on the TNT Color Card or the reference range equals 210 - 250 units using *the* **DTECHTOR** meter. At 75°F, this reaction will take approximately ten (10) minutes. The warmer the temperature, the quicker the development occurs. For example, at 85°F this reaction may take seven (7) minutes and at 60°F this reaction may take twenty (20) minutes.
- To stop color development and preserve the results for up to four (4) hours, remove the cup assembly from the meter head immediately after taking the test reading. Add approximately 8 drops (+/- 2 drops) of Reagent F solution (red cap) into each side of the cup assembly. Allow the liquid to drain completely. (See Step 8 on page 2).

SAMPLE COLLECTION/EXTRACTION:

- Use special care during sample collection, handling, storage and transportation to insure accurate results.
- The extraction is easier to perform if the soil is broken into sections during its addition to Bottle 1.
- Avoid splashing any acetone from Bottle 1 when adding the soil plug. The rate at which the soil is expelled from the sampling tool can be controlled by squeezing the barrel of the sampling tool when depressing the plunger.
- Some soils, especially clays, may require extremely rigorous shaking during extraction. If after three (3) minutes the soil plug is not uniformly dispersed, continue shaking with a rigorous top to bottom motion until the sample disperses. This may take up to five (5) minutes.
- Allow ample time for the soil to settle in Bottle 1. A clear acetone layer should form on the top of the soil. Certain clays and other soils may require up to thirty (30) minutes to cleanly separate.
- A red or pinkish tint in the acetone extract may indicate a very high level of TNT contamination. Extreme care should be used when handling these samples.
- Samples containing high levels of TNT must be diluted prior to analysis. Dilution pacs may be ordered for this purpose.
- Used kits should be disposed of in accordance with applicable federal and local regulations.
- A quality control program should be included in the sampling protocol. The type of program necessary may vary by state, compound of interest and site.

the DTECHTOR:

- If the user either double-clicks too slowly or inadvertently presses the Square Button once, the meter will display ---- then the reading e.g. 64%. This inadvertent result should be disregarded (considered erroneous). Note that the meter will however store this erroneous result into its memory. The user can return to Step 5 on page 3 by removing the cup assembly and pressing the Red Square Button then the slide (on/off) switch.
- **The reference color of a single cup assembly (test) can be monitored by leaving the cup assembly in the meter head and double clicking the Square Button (repeating Step 6 on page 3) whenever a reference reflectance value is desired. Multiple cup assemblies can be monitored simultaneously. Removing a cup assembly when a reference value is being displayed returns the user to Step 5 on page 3.**

INTERPRETATION OF THE TEST

The D TECH® TNT test kit reports results in TNT Equivalents in a soil or water sample. The assay is standardized against pure TNT.

A positive test result may be due to the presence of TNT, a cross reactant or mixtures of these compounds. For best results, pre-characterize the site by analyzing a small number of representative samples. Compare the pre-characterization results to the cross reactivity table on page 6 of the users guide. If the site is primarily contaminated with TNT, the test will accurately assess the TNT concentrations. If the site is contaminated with TNT and other compounds displaying high cross reactivity, the test will slightly overestimate the TNT concentration.

Sample heterogeneity, sampling technique, extraction efficiency, and soil/water matrix effects all contribute to the variability in the D TECH® TNT immunoassay. To obtain information regarding a 96% confidence level around an action concentration please call our technical service hotline at 1-800-222-0342 for more information.

TESTING HIGHER TNT CONCENTRATIONS

Dilution pacs are available for testing soil samples with high TNT concentrations. For more information, please call our technical service hotline 1-800-222-0342

RELIABILITY

The D TECH® TNT Explosives Text Kit has been designed to minimize the effect of enviromental interferences. Sample pH, nitrate, nitrite and ammonium do not affect test results. Studies have shown the D TECH® TNT Test Kit to yield less than 1% false negatives and less than 8 % false positives throughout the working range of the kit.

SENSITIVITY

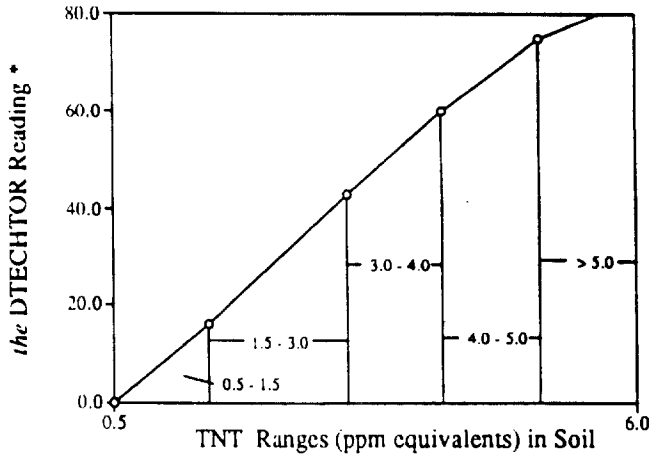
The D TECH® TNT Test Kit can be used to directly measure TNT in the following ranges:

Sample	*the* DTECHTOR	Color Card
Water (ppb)	5 - 45	5 - 60
Soil (ppm)	0.5 - 5.0	0.5 - 5.0

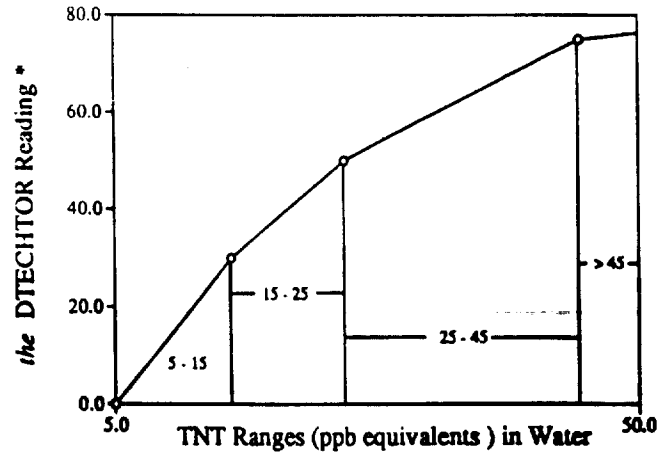
The Minimum Detection Limit (MDL) of the test for TNT in a water sample is 5 ppb and in soil is 0.5 ppm. The Minimum Quantitation Limit (MQL) occurs at a water sample concentration of 8 ppb and a soil sample concentration of 0.8 ppm.

TNT STANDARD CURVES

D TECH TNT Test Kit
Soil Standard Curve



D TECH TNT Test Kit
Water Standard Curve



*Percent Reflectance Relative to Reference

PERFORMANCE CHARACTERISTICS

SPECIFICITY

The D TECH® TNT Test Kit has been tested for cross-reactivity with structurally similar compounds, degradation products of TNT, other explosives and priority pollutants. The table below summarizes the cross reactivity of these compounds in samples using *the* **DTECHTOR**. A positive test result may be due to the presence of TNT, cross reactants or mixtures of these compounds. Samples testing positive for TNT should be confirmed by standard methods. The D TECH® TNT Test Kit has been designed to minimize the effect of environmental interferences.

Compound	IC_{50}[a] (ppb)	MDL (ppb)	%Cross-reactivity
TNT	22	5	100
Tetryl[b]	65	15	34
1,3,5-trinitrobenzene	96	20	23
2-amino-4,6-dinitrotoluene	200	30	11
2,4-dinitrotoluene	>500	120	< 1
4-amino-2,6-dinitrotoluene	>500	>500	< 1
2,6-dinitrotoluene	>500	>500	< 1
2,6-diaminonitrotoluene	>500	>500	< 1
2-nitrophenol	>500	>500	< 1
4-nitrophenol	>500	>500	< 1
2,4-dinitrophenol	>500	>500	< 1
RDX[b]	>500	>500	< 1
HMX[b]	>500	>500	< 1

a The IC_{50} (inhibition concentration at 50%) is defined as the concentration of tested material required to yield a 50% displacement on a TNTstandard concentration curve.

b Chemical Names:
Tetryl = methyl-2,4,6-trinitrophenylnitramine
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

INTERFERING SUBSTANCES

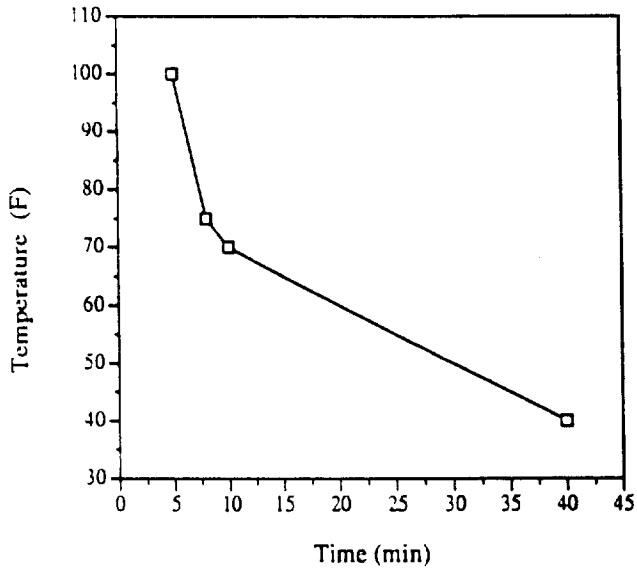
The D TECH® TNT Test Kit has been tested for results interference by other priority pollutants. A negative interference indicates the target compound, spiked into a TNT sample at 100 ppm, did not affect the TNT result. The table below summarizes the data.

Compound	% Cross-reactivity	Interference
BTEX	< 1	none
Aroclor 1254 (PCB)	< 1	none
Pentachlorophenol (PCP)	< 1	none

TIME-TEMPERATURE RELATIONSHIP

All enzyme immunoassays are temperature dependent. At cooler temperatures, the color development step of the D TECH® TNT test will take longer than 10 minutes. A time-temperature graph has been provided to illustrate this point. This graph should not be used to determine the time for a test at a given temperature, but rather as a guide to indicate the approximate time necessary to complete the development step. All tests should be run until the color produced by the reference matches the bar on the color card or the target reflectance range of 210-250 on *the* **DTECHTOR.**

D TECH® TIME-TEMPERATURE GRAPH



TEST VARIATION

The TNT Test Coefficient of Variation (CV), also known as the Relative Standard Deviation (RSD), has been evaluated at various concentrations. The data indicate the average test RSD, based on the concentration, is 9%.

QUALITY CONTROL

1. Read the test instructions completely before use to assure familiarity with the test procedure.
2. Monitor the storage conditions of the tests. Expiration dates are dependent on storage temperature.
3. To insure test reproducibility, investigators should confirm that all samples analyzed are homogeneous and representative of the site of interest.
4. A reference must be run with each test. The reference serves as a positive control to ensure the performance of the test and to verify that test procedures were properly followed.
5. Prior to analysis, the user should incorporate a quality assurance and quality control plan into the field testing procedure. We recommend adherence to US EPA data quality guidelines and suggest including the following steps in your QA/QC plan:
    a. Record the operator's name, the date, time of collection, and location of each sample.
    b. Record any raw data, calculations and final results for each sample.
    c. Document matrix and background effects by testing an uncontaminated sample taken on site.
    d. Run a duplicate analysis on one of every 20 samples.
    e. Confirm field sample analysis by submitting at least 10% of the samples for quantitation by an EPA approved method that is different from the field method. Representative samples should include 2 samples above and 2 samples below the minimum detection limit of the field assay.
6. Additional options:
    a. Use performance evaluation standards daily for assay validation.
    b. Document the method blank by completing the assay without introducing sample.
    c. Perform field analysis on a matrix spike to document any matrix effect on the analyte measured.

HEALTH/SAFETY

Material Safety Data Sheets (MSDS) have been supplied with the purchase of this product. The MSDS should be read before using this test. During the execution of the test, any excess TNT is absorbed into the **Cup Assembly** absorbent plug. It is not retained on the surface of the **Cup Assembly**.

PROTECT EYES WITH SAFETY GLASSES AND PROTECT SKIN WITH PROTECTIVE GLOVES

Associated Hazards: May be irritating to skin, eyes, and mucous membranes.

Symptoms of Exposure: May be irritating on contact with skin, eyes, and mucous membranes.

First Aid Measures: GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE

Skin: Wash thoroughly with soap and water.

Eyes: Immediately flush with water for at least 15 minutes.

Inhalation: Remove to fresh air. Give artificial respiration if breathing has stopped.

Ingestion: Get immediate medical attention. If conscious, give water freely.

SDI

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D TECH®
Environmental Detection Systems

DTECHTOR Meter with Added Program Feature
[red square operating button]

Phone: (800) 544-8881
(215) 860-5115
Fax: (215) 860-5213

the DTECHTOR Meter can be used to "READ" the reference color development; instead of visually matching the reference color to the color card. This feature allows the user to more precisely determine when to read the results of the D TECH TNT, RDX, PCB, and PAH assays. The operating instructions included on this page are to be utilized with DTECHTOR meters possessing a red square operating button.

Step 1: Insert Calibrator into the Meter Head and hold firmly in place.
Display ZERO

Step 2: Press the Square Button 1 time. When the calibration is complete the meter will display
Display SET

Step 3: Remove Calibrator and return it to its protective canister.
Display remains..... SET

Step 4: SELECT METER PROGRAM

For TNT Test

Press the Square Button 1 time to select meter program !3
Display..... SET #1

or **For RDX, PCB or PAH Tests**

Press the Square Button 2 times to select meter program #2
Display..... SET #2

Step 5: Insert Cup Assembly (test) into the Meter Head and firmly hold in place
Display..... TEST #1 or TEST #2

Step 6: **READ the Reference Color**
Double-click (as you would with a computer "mouse") the Square Button
Display..... -- ..... then Reference Side Reading (i.e. 366)

If the user either "double-clicks" too slowly or inadvertently only presses the Square Button one time see Note #1.
For helpful hints on the monitoring more than one test at a time see Note #2.

Test should be read when the Reference Side Reading is in the target range listed below for the appropriate test. References Ranges are as follows:

TNT	250-210
RDX	350-320
PAH	410-380
PCB	345-315

If the reference side reading is above the target range; further color development time is needed.

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If the reference side reading is below the target range, color development has been allowed to proceed too long. If this situation occurs the test should be rerun. The greatest accuracy of result interpretation is achieved when the test is read when the reference side reading is within the target range.

IMMEDIATELY after the target reference range value has been reached:
Proceed to Step 7 to obtain an immediate result

Step 7: Obtain the test result
Press the Square Button 1 time.
Display..... — .....then **Test Reading (i.e. 46%)**
Use the DTECHTOR Table (see page 3 of the test kit instruction guide) and the percent relative reflectance meter reading to determine the concentration of analyte.

Step 8: Record result, then press Square Button 1 time.

Step 9: Key in 4 digit label. (Optional - see meter operator's guide)

Step 10: Remove Cup Assembly (test)
Display..... SET #1 [For TNT Test]
or SET #2 [For RDX, PCB, or PAH tests]

Step 11: Insert next Cup Assembly (test) and repeat procedure beginning at Step 4.

NOTE #1: If the user either "double-clicks" too slowly or inadvertently only presses the Square Button one time the meter will display.....—.....then Reading (i.e. 64%).
This inadvertently obtained result should be disregarded (considered erroneous). It must be noted, however that the meter will store this erroneous result into its memory. The user is returned to Step 4 by removing the cup assembly, and pressing the square button then the slide (on/off) switch.

NOTE #2: The reference color of a single cup assembly (test) can be monitored by leaving the cup assembly in the meter head and "double-clicking" the square button (repeating Step 6) whenever a reference reflectance value is desired. Multiple cup assemblies (tests) can be monitored simultaneously. Removing a cup assembly (test) when a reference reflectance value is being displayed returns the user the Step 4.

GENERAL NOTES:

The longer the color is allowed to develop, and the darker it becomes, the lower the reference side reading (reflectance unit number).

To stop color development/preserve results [up to 4 hours]:
Remove the cup assembly from the meter head. Add approximately 8 drops (+/- 2 drops) of Reagent F solution (red cap) into each side of the cup assembly. Allow liquid to drain completely.

Questions should be directed to technical service or the product manager. Please call our technical service hotline